

## Brief Article

# Attention deficit hyperactivity disorder in children with visual diseases

Maryam Moghadasin<sup>1</sup>, Parvin Dibajnia\*<sup>2</sup>, Mehdi Samimi Ardestani<sup>3</sup>, Alireza Zahiroddin<sup>4</sup>

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## Abstract

**Introduction:** The purpose of our study was to evaluate the frequency of behavioral problem in pre school-aged children with visual problem.

**Methods:** In this expost facto study, which was selected via convenient sampling, 143 children ranging in age from 3-6 years that refer to optometry clinic for routine eye examination were evaluated.

After complete ocular exams including evaluation of visual acuity with and without glasses, refraction with and without cycloplegic eye drops; we took written consent from parents, and obtained a detailed history of the children. One parent of each child completed the Conner's Parent Rating Scale(CPRS).

The CPRS scores of children with eye problem (30 cases) were compared with the normative sample (113 cases with normal eye exam) by t-test. We used ANOVA test to determine differences in outcomes between groups.

**Results:** After complete ocular exams in order to diagnosis visual problems in 143 children 77 (54%) boys and 66(46%) girls that participated in our study with a mean age of 5.14 years (SD =3.64), 113 clients were normal, 23patients with refractive error and 7 child had amblyopia.

**Conclusion:** Our results suggest that children ranging in age from 3to 6 years with eye problem have not a higher behavioral problem as measured by the CPRS than normal children.

**Declaration of Interest:** None.

**Keywords:** Disorder, Attention deficit hyperactivity, Child, Eye diseases.

## Introduction

Vision screening programs in many countries are undertaken for early detection and care of eye problems in children. Usually the health care providers perform such eye screening and

optometrists at vision centers carry out further management of children with defective vision (1).

The World Health Organization and Vision 2020 included refractive error as a priority in the prevention of childhood blindness and they also recommend low vision care for children (2). Accordingly, the assessment of school children for trachoma, anatomic defects, refractive error, and amblyopia at 5–6 years of age, 12–13 years of age, and 15–16 years of age for refractive error has been adopted by many member countries (3).

Behavioral disorders have little to do with eyes and even less to do with optometry. However, the fact that vision occurs in the brain and not in the eyes, and that vision co-mingles extensively with social and emotional pathways in the brain, compels us to

1. Ph.D student in Psychometric, Allameh Tabatabaie University, Tehran, Iran.  
2. Professor of Psychiatry, Shahid Beheshti University Of Medical Sciences Faculty of Rehabilitation sciences, Tehran, Iran.  
3. Associate professor of Psychiatry, Shahid Beheshti University of Medical Sciences.  
4. professor of Psychiatry, Behavioral Sciences Research Center Shahid Beheshti University Of Medical Sciences, Tehran, Iran.  
**Corresponding Author:** Parvin Dibajnia, Imam Hossien Sq. Damavand Ave. School of Rehabilitation, Shahid Beheshti University Medical Sciences. Tehran, Iran Zip code: 16169-13111  
Tel-fax: +98-21 -77561406  
Email: pdibaj @ gmail.com

look more closely at the role of optometry in disorders such as attention deficit hyperactivity disorder (ADHD), oppositional defiance (ODD), bipolar disorder, and depression. The role that patient passive anxiety plays in the lives of optometric patients of all ages is increasingly being given its due accord, with anxiety rating scales now being developed for clinical and research purposes (4). One of the most commonly diagnosed behavioral disorders in children is attention deficit disorder. Behavioral disorders can significantly influence a child's responses in clinical optometric settings. Superficially it may appear that some children are simply "uncooperative" for examination or vision therapy procedures. In some instances visual performance may be substandard due to inadequately controlled behavioral disorders such as ADHD. In other instances, untreated visual problems making performance difficult may contribute to the behavioral disorder (5).

In multidisciplinary or specialty optometric practices, collaboration with a pediatric mental health professional can provide insight into the multifaceted nature of these disorders. Optometric treatment can enhance cognitive function and influence a child's mental state, and medical or allied mental health treatment can help in resolving visual components of brain-based behavioral disorders (6).

Abnormalities in development may be divided broadly into physical or behavioral categories. The physical challenges associated with development are usually held to be organ or system problems, distinct from behavioral issues, which are brain or mind-based problems.

Attention plays an important role in visual abilities of acuity, accommodation, vergency and motility. Many researchers no longer look at inattention and

neurobehavioral disorders as separate conditions with distinct labels, but rather as a spectrum of disorders (7,8).

The purpose of this study was to evaluate behavioral problem in pre school-aged children with visual disorder.

## Methods

In this ex-post facto study with convenient sampling, 143 children ranging in age from 3-6 years that refer to optometry clinic for routine eye examination were evaluated. Institutional review board or ethic committee approval was obtained. Exclusion criteria in our study included children with chronic diseases, intellectual disabilities, ADHD, psychiatry drugs used and history of severe eye trauma. We took written consent from parents, and obtained a detailed history of the children.

For diagnosis of eye problem, complete ocular exams including evaluation of visual acuity with and without glasses, refraction with and without cycloplegic eye drops, strabismus and other ocular diseases were done.

One parent of each child completed the Conner's Parent Rating Scale (CPRS). The CPRS scores of children with eye problem (30 cases) were compared with the normative sample (113 cases with normal eye exam) by t-test.

The CPRS uses 48 questions to evaluate a broad range of behavior in the following categories: conduct, inattention, hyperactivity, psychosomatic and anxious passive.

The CPRS asks the parent to rate the frequency of behaviors observed during the last months as follow: not true at all, just a little true, pretty much true, or very much true.

The CPRS was administered according to standardized instructions (9). According to the

procedures outlined in the manual the scores for the CPRS were converted to t-scores (mean of 50 and standard deviation of 10). Scores greater than 50 on the CPRS indicate a higher frequency of a behavior. The t-score was then compared with the normative sample for the CPRS.

Persian version CPRS-48 has good psychometric properties and total Cronbach's alpha 0.73 and Cronbach's alpha ranged from 0.60 to 0.75 for the subscales were reported (12).

Our analyses were carried out using SPSS 16.0 for windows (SPSS Inc, Chicago, IL USA). Descriptive analyses were computed in terms of mean and standard deviation for the entire sample as well as for group comparison between children with eye problem and healthy children.

In order to compare between two group (children with eye problem and healthy children) t-test were applied. We used ANOVA test to determine differences in outcomes between groups.

## Results

In our study, there are two groups including healthy children and children with eye problem respectively. The characteristics of these children were compared (table1). The gender and age difference between the two groups were not significant.

The prevalence of refractive error and amblyopia in 143 children including 77 (54%) boys and 66 (46%) girls participated in this study with a mean age of 5.14 years (SD =3.64), were 16% and 5% respectively. We have not found convergence insufficiency (CI) in this study. We observed no significant difference between two groups on sociodemographic parameters (Age, gender, birth delivery and weight delivery). Table 2 shows means and standard deviations for t-scores category of CPRS in the sample groups.

Findings of t-test for comparison between healthy children and children with eye problem on four categories of CPRS indicated no statistically significant difference.

The comparisons among three groups (normal children, refractive error children and amblyopic children) on the CPRS show that no statistically significant difference existed.

The results of ANOVA tests for comparison among three groups included: conduct problem category in normal group was 10.48 (SD=6.16), in refractive error group was 13.29 (SD=6.24), amblyopic children was 10.91 (SD=8.47). The results show that difference among three groups is not significant. ( $p=0.54, F=0.62$ ), psychosomatic category in normal group was 3.67 (SD=2.68), in refractive error group was 3.85 (SD =2.19), amblyopic group was 3.69 (SD=2.46). The results show that difference among three groups is not significant. ( $P=0.98, F=0.02$ ), anxious passive category in normal group was 3.83 (SD=2.43), in refractive error group was 4.71 (SD=2.29), amblyopic group was 3.48 (SD =1.68). The results show that difference among three groups is not significant. ( $P=0.47, F=0.77$ ). Also, inattentive, hyperactivity category in normal group was 7.09 (SD =5.05), in refractive error group was 10.57 (SD =5.53), amblyopic group was 7.78 (SD =6.37).

The results show that difference among three groups is not significant. ( $0.54 F=0.62$ ).

## Conclusion

Behavioral disorders have little to do with eyes and even less to do with optometry. However, the fact that vision occurs in the brain and not in the eyes, and that vision co-mingles extensively with social and emotional pathways in the brain, compels us to look more closely at the role of

**Table 1. Sociodemographic characteristics of the sample**

Variables	Healthy children	Eye problem	Total sample (n=143)	P
	Mean± SD			
Age  (Min-Max)	5.15 ±4.07  (3-6 years)	5.11 ±0.11  (3-6 years)	5.14 ±3.64  (3-6 years)	T=0.21 (0.91)
Gender	Count (%)		Total sample (n=143)	P
Male	57 (%51)	20 (%67)	77 (%54)	X <sup>2</sup> =4.90 (0.083)
Female	56 (%49)	10 (%33)	66 (%46)	
Birth delivery	Count (%)		Total sample (n=143)	P
Normal	87 (%79)	21 (%72)	108 (%78)	X <sup>2</sup> = 2.41(0.30)
Cesarean	23 (%21)	8 (%28)	31 (%22)	
Weight delivery	Mean± SD		Total sample (n=143)	P
	3.16 ±0.51	3.08 ±0.49	3.14 ±0.52	T=0.51 (0.52)

**Table 2. Scores for the CPRS between two groups**

Category	Mean T score (SD)		Independent-samples t- test	
	Healthy	Eye problem	T test	P
Conduct problem	49.68(9.38)	51.19(12.15)	-0.73	0.47
Inattention-impulsive-hyperactive	49.47(9.49)	51.99(11.68)	-1.23	0.22
psychosomatic	49.95(10.27)	50.18(9.05)	-0.11	0.91
Anxious-passive	50.06(10.48)	49.78(8.06)	0.14	0.89

vision in disorders such as attention deficit (AD/HD), oppositional defiance (ODD), conduct (CD), anxiety, psychosomatic and depression.

For explaining the relationship between behavioral patterns and eye problem we think the brain have many centers with many different highly specialized functions. Therefore, if we are having a problem even in a relatively minor part of the circuit, it can affect our overall attention performance.

In our study the results showed that difference between three groups (refractive error, amblyopia, normal) is not significant. We didn't find convergence insufficiency (CI) in our sample. *Convergence insufficiency is an eye problem that makes more difficult to concentrate on near work and difficult to keep both eyes focused on a near*

*target and since this is also one of the ways doctors diagnose ADHD, children with vision problems can be mislabeled.*

Dr. David Granet, found that it is three times more common in children with ADHD than in other children (13).

Borsting et al. found that children with a diagnosis of CI scored higher on the psychosomatic, learning problem and hyperactive categories on the CPRS when compared with a group of children with normal vision (14). Moreover, in another study they suggest that school-aged children with symptomatic accommodative dysfunction or CI have a higher frequency of behavior related to school performance and attention as measured by the conner' test (15).

Farrar et al. and Damari et al. showed a possible

relationship between behaviors associated with ADHD and common symptoms of vision problems (16, 17).

We would like to emphasize that ADHD behavior and visual problems can co-exist. Many children have ADHD behaviors that are exacerbated by visual problems. When visual problems are treated appropriately, ADHD behaviors diminish, though may not resolve entirely.

Unfortunately, most psychiatrists and pediatricians are not familiar with convergence insufficiency and maybe the best thing that comes out of this is that those experts dealing with ADHD behaviors will be more aware of this problem.

The present study has several limitations. First, the sample size is fairly modest, and the results obtained should be replicated in larger samples. We were able to show that the better association between vision problem and behavior when uses equal sample size in each group. Second, we used Persian Conner's Parent Rating Scale (CPRS) for screening behavioral disorder. For more accurate behavioral disorder diagnosis, clinical interview with children and parents are suggested.

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